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**SEA TECH INC.** FAX 503-757-7027 TELEX 258519 CTEK  
P.O. Box 779 • Corvallis, Oregon 97339 • 503-757-9716

**PROGRESS REPORT  
TO  
OFFICE OF NAVAL RESEARCH**

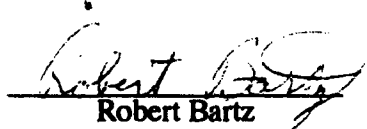
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**ELECTE**  
**JUN 1 1 1992**  
**S C D**

**FOR CONTRACT NO: N00014-90-C-0123**

**TITLE: Development of an Expendable Particle Sensor**

**ITEM NO: 0001AD**

**DATE: 6 May 92**

  
**Robert Bartz**  
Principal Investigator

**DISTRIBUTION STATEMENT A**

Approved for public release;  
Distribution Unlimited

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**92-13312**



## PROGRESS REPORT:

### Development of an Expendable Particle Sensor

Sea Tech Inc.

Contract No. N00014-90-C-0123

Item No. 0001AD

## INTRODUCTION:

This report addresses progress on the Phase II Development of the Expendable Particle Sensor (EPS) over the time period of February through March 1992. Technical progress during this time involved improving the telemetry software and fixing hardware problems we discovered with the telemetry receiver electronics.

During this time period several questions have surfaced with regard to the hydrodynamic design of the expendable probe body. Sea Tech, Sparton of Canada, ONR and NOARL personnel all are concerned about the placement of the scattering sensor in the expendable probe body. The problem is that little or no hydrodynamic information is known about the expendable probe currently used for XBT's. To solve this problem, Sea Tech is presently attempting to employ a consultant, Dr. Joe Katz at Johns Hopkins University to study the hydrodynamics of the expendable probe body. Funding for this work will be partially provided by the NOARL contract. Some funding may be necessary from the ONR SBIR contract, if so a formal request to ONR allowing Sea Tech to provide these funds from the present SBIR contract will be made at a later date.

Sea Tech and Sparton have signed a sub-contract to develop the underwater light scattering sensor and a copy of this contract is included in Appendix A. The start date for the contract is 1 February 1992. Since that time Sparton has made progress towards the development scattering sensor and their progress reports are included in Appendix B.

## RESULTS:

The software for the telemetry system was improved from preliminary test software to the point where it was ready to be tested in the field with prototype EPS's. The software was written to count frequencies twice during the transmission of each channel of data. This allows us to identify bad counts, which typically had been occurring about once every 250 samples. With the double count, both counts must be bad for us to get a bad sample; this occurs only about once every 60,000 samples. Other improvements to the software included a clearer presentation of data on the screen and automation of the setting of parameters which were previously set by the user. The program, called XOTD.PAS is found in Appendix C.

A couple of minor changes were made in the telemetry receiver hardware as well, shown in Figure 1. The most significant of these was using a 74C904 buffer to prevent undershoot on the read and write pulses. The undershoot had occurred when we used this receiver card with fast computers, such as 386 based models. The buffer solved this problem. Another change was using the other half of the 74HC123 to pass only data less than 10KHz. This eliminates jitter on the data, essentially serving the same function as the hysteresis in the comparator. The advantage is that this new scheme does not require careful setting like the hysteresis in the comparator. Thus we could eliminate the feedback resistor (potentiometer) on the comparator.

Statement A per telecon  
Dr. Richard Spinrad ONR/Code 1123  
Arlington, VA 22217-5000

NWW 6/10/92



Session For	
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## **Appendix A**



**SEA TECH INC. FAX 503-757-7027 TELEX 258519 CTEK**  
**P.O. Box 779 • Corvallis, Oregon 97339 • 503-757-9716**

**Sea Tech, Inc.  
P.O. Box 779  
Corvallis, OR 97339**

**Subcontract Agreement  
No. C ONR/EPS2S**

**Subcontractor: Sparton of Canada  
99 Ash Street  
London, Ontario  
Canada N5Z 4V3**

**Subcontract Type: Firm Fixed Price**

## **INTRODUCTION**

This Subcontract Agreement effective 01 February 1992 is made between Sea Tech, Inc. (hereinafter known as "Buyer"), a Oregon corporation with principal offices in Corvallis, Oregon, and Sparton of Canada (hereinafter known as "Seller"), a corporation with principal office in London, Ontario, Canada. The effort to be performed by Seller under this Subcontract will be part of Buyer's Contract No. N00014-91-C-0123. The work, defined in Attachment I will be performed on a Firm Fixed Price Basis, in accordance with Schedule A (Specific Terms and Conditions), Schedule B (General Provisions), Schedule C (Contract Flow-Down Requirements), and any referenced specifications.

# **SPARTON**

**SPARTON OF CANADA LTD.**

February 20, 1992

SOC Refer: 8007

## **Revised Proposal Budget**

### **Sparton of Canada Subcontract with Seatech**

1. N00014-91-C-6022
2. Total dollar amount of proposal \$325,000.00
3. Direct Material Costs

Purchased Parts	\$ 48,941.03	
Raw Material	4,617.08	
Standard Commercial Items	38,783.46	
Material Handling 10%	9,234.16	
Total Material		\$101,575.73
4. Direct Labour Costs

Total Hours 3,237	\$54,510.91	
Engineering Overhead 138.4%	75,443.10	
Total Labour		\$129,954.01
5. Travel and Living

3 trips, 2 people, 5 days to test range	\$ 2,958.00	
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6. G&A and Profit

	\$ 90,512.26	
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7. Total Subcontract

	\$325,000.00	
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## SCHEDULED A

### Specific Terms and Conditions

#### 1.0 Period of Performance

The period of performance for this subcontract is 01 February 1992 to 01 February 1994, unless amended in writing by mutual agreement of the parties. Seller is not obligated to continue work or provide services and Buyer is not obligated to compensate Seller for expenses incurred or commitments made before or after these dates.

#### 2.0 Contract Price

Subcontractor agrees to deliver all items and to render all services and performance required hereunder to Buyer for the Firm Fixed Price of U.S. \$325,000.00.

#### 2.1 Funding

This Subcontract is funded in the amount of U.S. \$162,500.00. It is anticipated that from time to time additional funds will be allotted to this contract until the total price of these items is allotted. Unless this Subcontract is amended in writing by mutual agreement of the parties, Buyer is not obligated to compensate Seller beyond the amount stated.

#### 2.2 Deliverables/Payment

	<u>Qty.</u>	<u>Price</u>	<u>Delivery</u>
Progress Report	1 each	32,500.00	28 February 1992
Progress Report	1 each	32,500.00	31 March 1992
Progress Report	1 each	32,500.00	30 April 1992
Progress Report	1 each	32,500.00	29 May 1992
Progress Report	1 each	32,500.00	30 June 1992
Progress Report	1 each	20,000.00	31 July 1992
Progress Report	1 each	20,000.00	30 September 1992
Progress Report	1 each	20,000.00	30 November 1992
Progress Report	1 each	20,000.00	29 January 1993
Progress Report	1 each	20,000.00	31 March 1993
Progress Report	1 each	20,000.00	29 May 1993
Progress Report	1 each	10,000.00	30 July 1993
Progress Report	1 each	10,000.00	30 September 1993
Progress Report	1 each	10,000.00	30 November 1993
Final Report	1 each	12,500.00	31 March 1994

### 2.3 Invoices

Invoices will be mailed in quadruplicate, to:

Sea Tech Inc.  
P.O. Box 779  
Corvallis, OR 97339

Invoices will clearly reference the Subcontract number shown on the cover page of this Subcontract. Payment to Sparton of Canada will be due within ten days of receipt of payment to Sea Tech from the US Government.

### 3.0 Technical and Contractual Representatives

The following authorized representatives are hereby designated for this Subcontract:

For Seller Technical: Mr. Gerry Keogh  
Contractual: Mrs. Lyn Jerrett-Organ

For Buyer Technical: Mr. Bob Bartz  
Contractual: Mrs. Donna Zirkle

### 3.1 Contacts

Contacts with Buyer which affect the Subcontract price, schedule, statement of work or other subcontract terms and conditions shall be made with authorized contractual representative. No changes to this Subcontract will be binding upon Buyer unless incorporated in a written modification to the Subcontract and signed by Buyer's contractual representative. The effort set forth in Attachment 1 shall be performed under the technical direction of Buyer's technical representative. When, in Seller's opinion, such technical direction constitutes a change to the Subcontract Agreement, Buyer's contractual representative shall be notified immediately for authorization of such change. Until such authorization is granted by Buyer's contractual representative, Seller shall perform in accordance with the Subcontract Agreement as written.

### 4.0 Key Personnel

For the purpose of this clause, "Key Personnel" are defined as those individuals who are mutually recognized by Buyer and Seller as essential to the successful completion and execution of this Subcontract.

Personnel designated as "Key Personnel" shall be assigned to the extent necessary for the timely completion of the task to which assigned. Any substitution or reassignment involving Seller's "Key Personnel" shall be made only with persons of equal abilities and qualifications and subject to written prior approval of Buyer.

Buyer reserves the right to direct the removal of any individual assigned to this Subcontract.

Seller's Key Personnel is: Mr. Gerry Keogh, Director of Engineering/Program Manager.

5.0 Assignments and Subcontracts

This subcontract is not assignable and shall not be assigned by Seller without the prior written consent of Buyer. Further, Seller agrees to obtain Buyer's approval before subcontracting this order or any substantial portion thereof; provided, however, that this limitation shall not apply to the purchase of standard commercial supplies of raw materials.

6.0 Indemnification

Seller shall indemnify and save Buyer harmless from and against any and all liability for injury to persons or property occasioned wholly or in part by an act or omission of Seller, its lower-tier subcontractors, agents, or employees, including any and all expense, legal or otherwise, incurred by Buyer in the defense of any claim or suit arising out of the work done under this Subcontract; provided, however, that Seller shall not be liable for injury to persons or property caused by the sole negligence of Buyer, its agents and employees.

Buyer shall promptly notify Seller of any claim against Buyer which is covered by this indemnification provision and shall authorize representatives of Seller to settle or defend any such claim or suit and to represent Buyer in, or to take charge of, any litigation in connection therewith.

7.0 Infringement Indemnity

- (a) In lieu of any other warranty by Buyer or Seller against infringement, statutory or otherwise, it is agreed that Seller shall defend at its expense any suit against Buyer or its customers based on a claim that any item furnished under this order or the normal use of sale thereof infringes any U.S. Letters, Patent, or copyright, and shall pay cost and damages finally awarded in any such suit, provided that Seller is notified in writing of the suit and given authority, information, and assistance at Seller's expense for the defense of same. If the use or sale of said item is enjoined as a result of such suit, Seller, at no expense to Buyer, shall obtain for Buyer and its customers the right to use and sell said item or shall substitute an equivalent item acceptable to Buyer and extend this patent indemnity thereto.
- (b) Notwithstanding the foregoing paragraph, when this order is performed under the Authorization and Consent of the U.S. Government to infringe U.S. Patents, Seller's liability for infringement of Such Patents in such performance shall be limited to the extent of the obligation of the Buyer to indemnify the U.S. Government.

8.0 Non-waiver of Rights

The Failure of Buyer to insist upon strict performance of any of the terms and conditions in the Subcontract or to exercise any rights or remedies, shall not be construed as a waiver of its rights to assert any of same or to rely on any such terms or conditions at any time thereafter. The invalidity in whole or in part of any terms or conditions of this

Subcontract shall not affect the validity of other parts hereof.

9.0 Disputes

(a) Any dispute arising under this Subcontract which is not settled by agreement of the parties or pursuant to Paragraph (b) below may be settled by appropriate legal proceedings. Pending any decision, appeal, or judgment referred to in this clause or the settlement of any dispute arising under this Subcontract, Seller shall proceed diligently with the performance of this Subcontract.

(b) Notwithstanding any provisions here to the contrary:

1. If a decision or any question of fact arising under the Prime Contract is made by the Contracting Officer and such question of fact is also the same question under this Subcontract, said decision, if binding upon Buyer under the Prime Contract, shall in turn be binding upon Buyer and Seller with respect to such question insofar as it relates to this Subcontract, provided, however, that if Seller is adversely affected by any such decision made by the contracting Officer, and if Buyer elects not to appeal such decision pursuant to the "Disputes" clause of the Prime Contract, Buyer shall promptly notify Seller. If Seller, thereafter, timely requests Buyer to appeal such decision, Buyer shall do so.

If Buyer appeals such decision, whether at its election or at Seller's request, any decision upon such an appeal, if binding upon Buyer under the Prime Contract shall in turn be binding upon Buyer and Seller under this Subcontract with respect to such question of fact insofar as it relates to this subcontract.

2. If any such appeal is denied or otherwise decided adversely to Seller's interest, or if Seller is otherwise adversely affected by any decision made by a representative of the contracting officer on any question of fact and/or law arising under the Prime Contract which is also related to this Subcontract, from which an appeal under the "Disputes" clause in the Prime Contract is not available, said decision, if binding upon Buyer under the Prime Contract, shall in turn be binding upon Buyer and Seller with respect to such question insofar as it relates to this Subcontract; provided, however, that if Seller is adversely affected by any such decision, and if Buyer elects not to bring suit against the Government with respect to such decision, Buyer shall notify Seller with reasonable promptness. If Seller timely requests Buyer to bring suit against the Government, Buyer shall do so. If Buyer brings suit against the Government, with respect to any such decision, whether at its election or at Seller's request, a final judgment in any such suit, if binding upon Buyer under the Prime Contract shall in turn be binding upon Seller and Buyer under this Subcontract with respect to the question decided insofar as it relates to this Subcontract.

3. If any such appeal or suit is taken or brought by Buyer whether at its election or at Seller's request, Seller shall assist Buyer in its prosecution thereof, to the extent Seller's interest may be affected. To the extent requested by Buyer, Seller shall prosecute for Buyer any appeal or suit taken or brought at Seller's request and, in such event, Buyer shall assist Seller in every reasonable manner. All costs and expenses incurred by Seller and Buyer in prosecuting any appeal or suit taken or brought at Seller's request shall be paid by Seller. Where practicable, Buyer shall, in good faith, consult with Seller concerning the presentation to the Contracting Officer or other cognizant representatives of the Government, or in court actions, of the questions referred to in paragraph 1. and 2. above to the extent they may affect Seller's interest.
4. If as a result of any decision or judgment which is binding upon Seller and Buyer, as above provided, Buyer is unable to obtain reimbursement from the Government under the Prime Contract for, or is required to refund or credit to the Government, any amount with respect to any item of cost or fee for which Buyer has reimbursed Seller, Seller shall, on demand, promptly repay such amount to Buyer.
5. The rights and obligations described herein shall survive completion of and final payment under this Subcontract.

#### 10.0 Entire Agreement

Upon acceptance of this Subcontract, Seller agrees that the provisions under this Subcontract including all documents incorporated herein by reference, shall constitute the entire Agreement between the parties hereto and supersede all prior agreements relating to the subject matter hereof. This contract may not be modified or terminated orally, and no modification nor any claimed waiver of any of the provisions hereof shall be binding unless in writing and signed by the party against whom such modification or waiver is sought to be enforced.

#### 11.0 General Relationship

Seller agrees that in all matters relating to this Subcontract it shall be acting as an independent contractor and shall assume and pay all liabilities and perform all obligations imposed with respect to the performance of this Subcontract. Seller shall have no right, power or authority to create any obligation, expressed or implied, on behalf of Buyer and/or the Government and shall have no authority to represent Buyer as an agent.

#### 12.0 Acknowledgement of Sponsorship

The Contractor agrees that in the release of Information relating to this contract such release shall include a statement to the effect as to what agency the project or effort depicted was or is sponsored by.

### 13.0 Technical Information/License Agreement

All technical information including drawing, descriptions, oral disclosures, and the like previously, herewith or hereafter given to Sparton of Canada by Sea Tech Inc. remain the private confidential property of Sea Tech Inc. and are to be used only for consideration of this proposal or solicitation. Such technical information may not be disclosed to others and may not be used by Sparton of Canada except under the terms of this contract, unless the technical information was previously known by Sparton of Canada or has been previously published.

It is the desire of the parties to enter into a formal license agreement at some future date. It is the intention of Robert Bartz, sole owner of Sea Tech Inc. to license the exclusive right to manufacture expendable underwater forward light scattering sensors. It is the intention of Sparton of Canada to buy from Robert Bartz, sole owner of Sea Tech Inc. the exclusive right to manufacture expendable underwater forward light scattering sensors. The cost for the license to produce the underwater forward light scattering sensor will be negotiated at a future date. A starting position for negotiations is approximately 5% of the selling price of the instrument and/or expendable probe produced that contains an underwater forward light scattering sensor. The term over which the license agreement applies will be the term of the underwater forward light scattering sensor patent protection.

### 14.0 Order of Precedence

In the event of an inconsistency or conflict between or among the provisions of this subcontract, the inconsistency shall be resolved by giving precedence in the following order:

- |                  |   |
|------------------|---|
| 1. Attachment I: | Proposal for Development of an Expendable Optical Scattering Temperature Depth Probe (XOTD) |
| 2. Schedule A:   | Specific Terms and Conditions   |
| 3. Schedule B:   | General Provisions  |
| 4. Schedule C:   | Contract Flow-Down Requirements   |

IN WITNESS WHEREOF, the duly authorized representatives of the Buyer and the Seller have executed this Subcontract on the dates shown.

FOR SPARTON OF CANADA

SEA TECH, INC.

[Signature]  
SIGNATURE

[Signature]  
SIGNATURE

[Name]  
NAME

[Name]  
NAME

[Title]  
TITLE

[Title]  
TITLE

[Date]  
DATE

[Date]  
DATE

## Schedule B

### GENERAL PROVISIONS

#### Fixed-Price Subcontracts

The following provisions for the Federal Acquisition Regulations ("FAR"), 48 C. F. R. Ch. 1, and the Department of Defense Federal Acquisition Regulation Supplement ("DFAR"), 48, C.F.R. Ch. 2, are incorporated by reference herein and shall be of like effect as if fully set forth herein, except that, whenever necessary to render a provision compatible with this contract the terms "Government" and "Contracting Officer" shall mean buyer and its duly authorized representative for this contract, the term "contractor," shall mean seller as defined herein, and the term "contract" shall mean this Subcontract. Unless otherwise specified in the clause or in regulations applicable thereto, the applicable clauses shall be the version in effect on the date of this Subcontract.

#### I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES

FAR NUMBER	CLAUSE TITLE	DATE OF CLAUSE
52.203-1	Officials Not to Benefit	1984 Apr
52.203-3	Gratuities	1984 Apr
52.203-5	Covenant Against Contingency Fees	1984 Apr
52.203-6	Restriction on Subcontractor Sales to the Government	1985 Jun
52.203-7	Anti-Kickback Procedures	1987 Feb
52.204-2	Security Requirements	1984 Apr
52.208-1	Required Sources for Jewel Bearings & Related Items	1984 Apr
52.210-5	New Materials	1984 Apr
52.212-8	Priorities, Allocations, & Allotments (If the contract exceeds \$2,500)	1984 Apr
52.212-13	Stop Work Order	1984 Apr
52.215-1	Examination of Records by Comptroller General (If this contract exceeds \$10,000)	1984 Apr
52.215-2	Audit-Negotiation (If contract exceeds \$10,000)	1984 Apr
52.215-22	Price Reduction for Defective Cost or Pricing Data	1985 Apr
52.215-24	Subcontractor Cost or Pricing Data	1985 Apr
52.219-3	Utilization of Small Business Concerns and Small Disadvantaged Business Concerns (If this contract exceeds \$25,000)	1984 Apr
52.219-9	Small Business & Small Disadvantaged Business Subcontracting Plan (If this Subcontract exceeds \$500,000 and the subcontractor is not a Small Business)	1984 Apr

FAR NUMBER	CLAUSE TITLE	DATE OF CLAUSE
52.204-7005	Overseas Distribution of Defense Subcontracts (If this contract exceeds \$100,000)	1982 Jun
52.208-7000	Required Sources for Miniature & Instrument Ball Bearings	1971 Jun
52.208-7001	Required Sources for Precision Components for Mechanical Time Devices	1971 Aug
52.208-7002	Required Sources for High-Purity Silicon	1983 Jun
52.215-7000	Aggregate Pricing Adjustment	1983 Apr
52.215-7001	Pricing of Adjustments	1983 Apr
52.225-7002	Qualifying Country Sources as Subcontractors	1980 Oct
52.225-7005	Buy American-Trade Agreements-Balance of Payment Program Certificate	1986 May
52.225-7006	Buy American Act-Trade Agreements Act-and the Balance of Payments Program	1986 May
52.225-7008	Duty-Free Entry-Qualifying Country End Products and Supplies	1984 Aug
52.225-7011	Preference for Domestic Specialty Metals (Major Programs)	1980 Oct
52.227-7013	Rights in Technical Data & Computer Software	1981 May
52.227-7013	Rights in Technical Data & Computer Software (Alternate I)	1981 May
52.227-7018	Restrictive Markings on Technical Data	1975 Mar
52.227-7026	Deferred Delivery on Technical Data or Computer Software	1974 Nov
52.227-7027	Deferred Ordering of Technical Data or Computer Software	1974 Nov
52.227-7029	Identification of Technical Data (If Technical Data is to be delivered under this contract)	1975 Mar
52.227-7030	Technical Data-Withholding of Payment	1976 Jul
52.235-7002	Recovery of Non-Recurring Costs on Commercial Sales (Applicable as prescribed at 35.7103(a))	1980 Feb
52.235-7004	Frequency Authorization	1986 Oct
52.219-13	Utilization of Women-Owned Small Business	1984 Apr
52.220-3	Utilization of Labor Surplus Area Concerns (If this contract exceeds \$25,000)	1983 Jun
52.220-4	Labor Surplus Area Subcontracting Program (If this contract exceeds \$500,000)	1984 Apr
52.222-3	Convict Labor	1984 Apr
52.222-4	Contract Work Hours & Safety Standards Act-Overtime Compensation-General (If this contract exceeds \$2,500)	1984 Apr
52.222-20	Walsh-Healy Public Contracts Act (If this contract exceeds \$10,000)	1984 Apr
52.222-26	Equal Opportunity	1984 Apr
52.222-35	Affirmative Action for Special Disabled & Vietnam Era Veterans	1984 Apr
52.222-36	Affirmative Action for Handicapped Workers	1984 Apr
52.223-2	Clean Air and Water	1984 Apr
52.223-3	Hazardous Material Identification	1984 Apr

Sch B/Fixed Price

FAR NUMBER	CLAUSE TITLE	DATE OF CLAUSE
52.225-10	Duty Free Entry (If this contract exceeds \$10,000)	1984 Apr
52.225-11	Certain Communist Areas	1984 Apr
52.227-1	Authorization & Consent - Alternate I	1984 Apr
52.227-2	Notice & Assistance Regarding Patent & Copy-right Infringement	1984 Apr
52.227-3	Patent Indemnity	1984 Apr
52.227-8	Reporting of Royalties (foreign)	1984 Apr
52.227-9	Refunding of Royalties	1984 Apr
52.227-10	Filing of Patent Applications - Classified Subject Matter	1984 Apr
52.227-12	Patent Right - Retention by the Customer (Long Form)	1984 Apr
52.229-3	Federal, State and Local Tax	1984 Apr
52.243-1	Changes - Fixed Price	1984 Apr
52.244-5	Competition in Subcontracting	1984 Apr
52.245-2	Government Property (Fixed Price Contracts)	1984 Apr
52.246-23	Limitation of Liability	1984 Apr
52.247-63	Preference for U.S. Flag Carriers	1984 Apr
52.249-2	Termination for Convenience of the Government (Fixed Price)	1984 Apr
52.249-8	Default (Fixed Price Supply and Service)	1984 Apr

## Schedule C

### CONTRACT FLOW-DOWN REQUIREMENTS

#### SECTION I - CONTRACT CLAUSES

Fixed Price R&D (SSIR) (JUNE 1991) (1)

- \*Applies when contract action exceeds \$10,000.
- \*\*Applies when contract action exceeds \$25,000.
- \*\*\*Applies when contract action exceeds \$100,000.
- +Applies when contract action exceeds \$500,000.
- x(DD 250).

(a) FAR 52.252-02 CLAUSES INCORPORATED BY REFERENCE (JUN 1989)

This contract incorporates the following clauses by reference, with the same force and effect as if they were given in full text. The Subcontractor is bound by the terms and conditions as applicable.

#### I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES: -

1. FAR 52.202-01 Definitions (APR 1984)
2. FAR 52.203-01 Officials Not to Benefit (APR 1984)
3. FAR 52.203-03 Gratuities (APR 1984)
4. FAR 52.203-05 Covenant Against Contingent Fees (APR 1984)
5. FAR 52.203-07 Anti-Kickback Procedures (OCT 1988)
- \*\*\*6. FAR 52.203-09 Requirement for Certificate of Procurement Integrity - Modification (NOV 1990)
- \*\*7. FAR 52.203-10 Price or Fee Adjustment for Illegal or Improper Activity (SEP 1990)
- \*\*\*8. FAR 52.203-12 Limitation on Payments to Influence Certain Federal Transactions (JAN 1990)
9. FAR 52.212-08 Defense Priority and Allocation Requirements (MAY 1986)
10. FAR 52.212-13 Stop Work Order (AUG 1989)
- \*11. FAR 52.215-01 Examination of Records by Comptroller General (APR 1984)
12. FAR 52.215-02 Audit - Negotiation (DEC 1989)
- +13. FAR 52.215-22 Price Reduction for Defective Cost or Pricing Data (JAN 1991)
- +14. FAR 52.215-24 Subcontractor Cost or Pricing Data (APR 1985)  
(The \$100,000 threshold figure appearing in this clause is revised to read \$500,000).
15. FAR 52.215-26 Integrity of Unit Prices (APR 1991)
16. FAR 52.215-26 Alternate I (APR 1991) (Applicable if action contracted under Other Than Full and Open Competition)
17. FAR 52.215-33 Order of Precedence (JAN 1986)
18. FAR 52.219-06 Notice of Total Small Business Set-Aside (APR 1984)

CONTRACT NUMBER: N00014-81-1-0100

Fixed Price R&D (SBIR) (JUNE 1991) (2)

- \*19. FAR 52.219-08 Utilization of Small Business Concerns and Small Disadvantaged Business Concerns (FEB 1990)
- \*\*20. FAR 52.219-13 Utilization of Women-Owned Small Businesses (AUG 1986)
- \*\*21. FAR 52.220-03 Utilization of Labor Surplus Area Concerns (APR 1984)
- 22. FAR 52.222-01 Notice to the Government of Labor Disputes (APR 1984)
- 23. FAR 52.222-03 Convict Labor (APR 1984) (Reserved when FAR 52.222-20 Walsh Healy Public Contracts Act is applicable)
- 24. FAR 52.222-04 Contract Work Hours and Safety Standards Act - Overtime Compensation (MAR 1986)
- 25. FAR 52.222-26 Equal Opportunity (APR 1984)
- \*26. FAR 52.222-35 Affirmative Action for Special Disabled and Vietnam Era Veterans (APR 1984)
- 27. FAR 52.222-36 Affirmative Action for Handicapped Workers (APR 1984)
- \*28. FAR 52.222-37 Employment Reports on Special Disabled Veterans and Veterans of the Vietnam Era (JAN 1988)
- \*\*\*29. FAR 52.223-02 Clean Air and Water (APR 1984)
- \*\*30. FAR 52.223-06 Drug-Free Workplace (JUL 1990) (Applies w/ n contract action equals or exceeds \$25,000, or when any modification increases the total contract value to \$25,000 or more)
- 31. FAR 52.225-11 Restrictions on Certain Foreign Purchases (APR 1991)
- 32. FAR 52.225-13 Restrictions on Contracting with Sanctioned Persons (APR 1991)
- 33. FAR 52.227-01 Authorization and Consent (APR 1984) and Alternate 1 (APR 1984)
- \*\*34. FAR 52.227-02 Notice and Assistance Regarding Patent and Copyright Infringement (APR 1984)
- \*\*35. FAR 52.229-03 Federal State and Local Taxes (JAN 1991)
- \*\*36. FAR 52.229-05 Taxes - Contracts Performed in U. S. Possessions or Puerto Rico (APR 1984)
- 37. FAR 52.232-02 Payments under Fixed-Price Research and Development Contracts (APR 1984)
- 38. FAR 52.232-09 Limitation on Withholding of Payments (APR 1984)
- 39. FAR 52.232-17 Interest (JAN 1991)
- 40. FAR 52.232-23 Assignment of Claims (JAN 1986)
- 41. FAR 52.232-25 Prompt Payment (APR 1989) (The words "the 30th day" are inserted in lieu of "the 7th working day" in subdivision (a)(6)(i).)
- 42. FAR 52.233-01 Disputes (APR 1984)
- 43. FAR 52.233-03 Protest After Award (AUG 1989)
- \*\*44. FAR 52.242-13 Bankruptcy (APR 1991)
- 45. FAR 52.243-01 Changes - Fixed Price (AUG 1987) and Alternate V (APR 1984)
- 46. FAR 52.244-01 Subcontracts (Fixed Price Contracts) (APR 1991)
- \*\*47. FAR 52.244-05 Competition in Subcontracting (APR 1984)
- 48. FAR 52.245-02 Government Property (Fixed-Price Contracts) (DEC 1989) and Alternate I (APR 1984)
- 49. FAR 52.246-09 Inspection of Research and Development (Short Form) (APR 1984)
- \*\*50. FAR 52.246-16 Responsibility for Supplies (APR 1984)

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- \*\*51. FAR 52.246-23** Limitation of Liability (APR 1984)
- 52. FAR 52.247-63** Preference for U.S. Flag Air Carriers (APR 1984)
- 53. FAR 52.249-01** Termination for Convenience of the Government (Fixed Price)(Short Form) (APR 1984)
- \*\*54. FAR 52.249-09** Default (Fixed Price Research and Development) (APR 1984)
- 55. FAR 52.253-01** Computer Generated Forms (JAN 1991)

**II. DEPARTMENT OF DEFENSE FAR SUPPLEMENT (DFARS) (48 CFR CHAPTER 2) CLAUSES: -**

- 1. DFARS 252.203-7001** Special Prohibition on Employment (FEB 1991)
- +2. DFARS 252.215-7000** Aggregate Pricing Adjustments (APR 1985) (The \$100,000 threshold figure appearing in this clause is revised to read \$500,000).
- 3. DFARS 252.227-7013** Rights in Technical Data and Computer Software (OCT 1988) and Alternate II (OCT 1988)
- 4. DFARS 252.227-7018** Restrictive Markings on Technical Data (OCT 1988)
- 5. DFARS 252.227-7029** Identification of Technical Data (APR 1988)
- 6. DFARS 252.227-7030** Technical Data - Withholding of Payment (OCT 1988)
- \*\*7. DFARS 252.227-7031** Data Requirements (OCT 1988)
- 8. DFARS 252.227-7036** Certification of Technical Data Conformity (MAY 1987)
- 9. DFARS 252.227-7037** Validation of Restrictive Markings on Technical Data (APR 1988)
- 10. DFARS 252.231-7000** Supplemental Cost Principles (APR 1991)
- \*\*\*11. DFARS 252.233-7000** Certification of Requests for Adjustment or Relief Exceeding \$100,000 (APR 1980)
- 12. DFARS 252.235-7003** Care of Laboratory Animals (APR 1974)
- 13. DFARS 252.243-7001** Pricing of Adjustments (APR 1984)
- x14. DFARS 252.246-7000** Material Inspection and Receiving Report (DEC 1969)

**(b) ADDITIONAL FAR AND DFARS CLAUSES**

This contract incorporates the following checked clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available.

     **FAR 52.204-02** Security Requirements (APR 1984) (Applicable if contract will generate or require access to classified information and DD Form 254, Contract Security Classification Specification, is issued to the Contractor)

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Fixed Price R&D (SBIR) (JUNE 1991) (4)

- X FAR 52.209-06 Protecting the Government's Interest when Subcontracting with Contractors Debarred, Suspended, or Proposed for Debarment (MAY 1989) (Applicable to contracts exceeding \$25,000 in value)
- FAR 52.215-27 Termination of Defined Benefit Pension Plans (SEP 1989) (Applicable to contract actions exceeding \$500,000 and when certified cost or pricing data is required)
- FAR 52.227-10 Filing of Patent Applications - Classified Subject Matter (APR 1984) (Applicable if contract is subject to FAR clause 52.204-02 and either 52.227-11 or 52.227-12)
- X FAR 52.227-11 Patent Rights - Retention by the Contractor (Short Form) (JUN 1989) (Applicable if contractor is a small business or nonprofit organization)
- FAR 52.232-16 Progress Payments (AUG 1987) and Alternate I (AUG 1987)
- FAR 52.232-28 Electronic Funds Transfer Payment Methods (APR 1989) (Applicable if Contractor has arranged for EFT payments)
- X DFARS 252.203-7002 Statutory Compensation Prohibitions and Reporting Requirements Relating to Certain Former Department of Defense (DoD) Employees (FEB 1991) (Applicable when contract action exceeds \$100,000 or when any modification increases contract amount to more than \$100,000)
- DFARS 252.203-7004 Prohibition Against Retaliatory Personnel Actions (APR 1991) (Applies when contract action exceeds \$500,000, or when any modification increases the contract amount to over \$500,000) (Does not apply if contract is for commercial items sold in substantial quantities to the general public where the price is based solely on established catalog or market price).
- DFARS 252.223-7500 Drug-Free Work Force (SEP 1988) (Applicable if contract will generate or require access to classified information and DD Form 254, Contract Security Classification Specification, is issued to the Contractor)
- X DFARS 252.227-7034 Patents - Subcontracts (APR 1984) (Applicable when clause at FAR 52.227-11 applies)
- X DFARS 252.227-7039 Patents - Reporting of Subject Inventions (APR 1990) (Applies when clause at FAR 52.227-11 applies)

CONTRACT NUMBER: N00014- 90-1-1123

Fixed Price RAD (SBIR) (JUNE 1991) (5)

DFARS 252.249-7001 Notification of Substantial Impact on Employment  
(MAY 1991) (Applies to all prime contracts valued  
at \$5 million or more, and to all contracts with  
subcontracts of \$500,000 or more).

(c) The following clause is applicable to contract actions exceeding \$25,000:

DFARS 252.247-7203 Transportation of Supplies by Sea (APR 1990)

(a) As used in this clause:

(1) "Armed services" means the Army, Navy, Air Force, Marine Corps, and Defense Agencies.

(2) "Components" means articles, materials, and supplies incorporated directly into end products at any level of manufacture, fabrication or assembly by the Contractor or any subcontractor.

(3) "Foreign flag vessel" means any vessel that is not a U.S.-flag vessel.

(4) "Ocean transportation" means any transportation aboard a ship, vessel, boat, barge, or ferry through international waters.

(5) "Subcontractor" means a supplier, materialman, distributor or vendor at any level below the prime contractor whose contractual obligation to perform results from, or is conditioned upon, award of the prime contract and who is performing any part of the work or other requirement of the prime contract.

(6) "Supplies" means all property, except land and interests in land, that is clearly identifiable for eventual use by the armed services, or owned by the armed services, at the time of transportation by sea. It includes (but is not limited to) public works, buildings and facilities, ships, floating equipment and vessels of every character, type, and description, together with parts, subassemblies, accessories, and equipment; machine tools, material, equipment, and stores of all kinds; and items, construction materials and the components of the foregoing. An item is clearly identifiable for eventual use by the armed services if, for example, the contract documentation contains a reference to a DoD contract number or a military destination.

(7) "U.S.-flag vessel" means a vessel of the United States or belonging to the United States, including any vessel registered or having national status under the laws of the United States.

(b) The Contractor shall employ United States-flag vessels, and no others, in the transportation by sea of any supplies to be furnished in the performance of its contractual obligations.

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Fixed Price R&D (SBIR) (JUNE 1991) (6)

(c) If the Contractor or a subcontractor believes that (1) U.S.-flag vessels are not available for timely shipment; (2) the freight charges are excessive or unreasonable; or (3) freight charges are higher than charges to private persons for transportation of like goods, the Prime Contractor, including subcontractors through the Prime Contractor, may request from the Contracting Officer, in accordance with paragraph (d) below, authorization to ship in foreign-flag vessels or designation of available U.S.-flag vessels. If the Prime Contractor's request to ship supplies in foreign-flag vessels, whether on its own account or on account of a subcontractor, is granted in writing by the Contracting Officer, the supplies may be shipped on foreign-flag vessels in accordance with the approval. The Contracting Officer may condition approval to ship on a foreign-flag vessel on an equitable adjustment of the contract.

(d) The request for use of other than U.S.-flag vessels because of matters concerning freight charges or matters concerning vessel availability must be submitted in writing by or through the Prime Contractor to the Contracting Officer at least forty-five (45) days prior to the sailing date for the shipper to meet its delivery schedules. Requests submitted after such date(s) will be processed as expeditiously as possible, but the failure of the appropriate official to grant approvals to meet the shipper's sailing date will not of itself constitute a compensable delay under this or any other clause of contract. The request shall contain at a minimum:

- (1) Type, weight, and cube of cargo.
- (2) Required shipping date.
- (3) Special handling and discharge requirements.
- (4) Loading and discharge points.
- (5) Name of shipper and consignee.
- (6) Prime contract number.

(7) A documented description of efforts made to secure U.S.-flag vessels, including points of contact with at least two (2) U.S.-flag carriers contacted by name and telephone number. Copies of telephone notes, tele-graphic and facsimile messages or letters will be sufficient for this purpose.

(e) The Contractor shall, within thirty (30) days after each shipment covered by this clause, provide the Contracting Officer and the Division of National Cargo, Office of Market Development, Maritime Administration, U.S. Department of Transportation, Washington, DC 20590, one copy of the rated on board vessel operating carrier's ocean-bill-of-lading, which shall contain the following information:

- (1) Applicable Government prime contract number:
- (2) Name of vessel:

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Fixed Price R&D (SBIR) (JUNE 1991) (7)

- (3) Vessel flag of registry;
- (4) Date of loading;
- (5) Port of loading;
- (6) Port of final discharge;
- (7) Description of commodity;
- (8) Gross weight in pounds and cubic feet if available;
- (9) Total ocean freight in U.S. dollars
- (10) Name of the steamship company.

(f) Along with the submission of its final invoice under this contract the Contractor agrees to provide a representation that to the best of its knowledge and belief:

(1) No ocean transportation was used in the performance of this contract;

(2) Ocean transportation was used and only United States-flag vessels were used for all ocean shipments under the contract. Legible copies of shipping documents have been submitted to the Contracting Officer and to the Maritime Administration in accordance with paragraph (e) of this clause;

(3) Ocean transportation was used, and to the extent any non-U.S.-flag vessels were used, the Contractor had the written consent of the Contracting Officer for all non-U.S.-flag ocean transportation; or

(4) Ocean transportation was used and some or all of the shipments were made on non-U.S.-flag vessels without the written consent of the Contracting Officer. These shipments were as follows:

<u>ITEM</u> <u>DESCRIPTION</u>	<u>CONTRACT</u> <u>LINE ITEMS</u>	<u>QUANTITY</u>
-----------------------------------	--------------------------------------	-----------------

Total

(g) If the final invoice does not include the required representation, it will be rejected and returned to the Contractor as an improper invoice for the purposes of the clause of the contract entitled "Prompt Payment". In the event there has been unauthorized use of non-U.S.-flag vessels in the performance of this contract, the Contracting Officer is entitled to equitably adjust the contract, based on the unauthorized use.

(h) The Contractor shall include this clause, including this paragraph (h), revised as necessary to reflect the relationship of the contracting parties;

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Fixed Price R&D (SBIR) (JUNE 1991) (8)

in all subcontracts hereunder. Subcontractor bills of lading shall be submitted through the prime contractor to the parties and with the information specified in paragraph (e) of this clause.

(d) The following clause is applicable when the Contractor has made a negative response to the inquiry in the representation at DFARS 252.247-7202.

X DFARS 252.247-7204 NOTIFICATION OF TRANSPORTATION OF SUPPLIES BY SEA (JAN 1990)

(a) The Contractor has indicated by the response to the solicitation provision at 252.247-7202, Representation of Extent of Transportation of Supplies by Sea, that it did not anticipate transporting by sea any supplies, as defined in the clause at 252.247-7203, Transportation of Supplies by Sea, in the performance of this contract. If, however, after the award of this contract, the Contractor should learn that supplies will be transported by sea, the Contractor shall notify the Contracting Officer of the fact that transportation by sea will be used and hereby agrees to comply with all the terms and conditions of the clause at 252.247-7203, entitled "Transportation of Supplies by Sea," contained in this contract.

(b) The Contractor shall include this clause, including this paragraph (b), revised as necessary to reflect the relationship of the contracting parties, in all subcontracts hereunder.

CONTRACT NUMBER: N00014-90-C-0123

**ATTACHMENT I**  
**PROPOSAL FOR**  
**THE DEVELOPMENT OF AN**  
**EXPENDABLE OPTICAL SCATTERING**  
**TEMPERATURE DEPTH PROBE (XOTD)**

**Sparton of Canada**

**Reference Log 91-68**

**March 12, 1992**

### **PROPRIETARY DATA NOTICE**

This document contains company proprietary designs and information, including trade secrets of Sparton of Canada, Limited. Any disclosure of this information is expressly prohibited. If any Government Department or Agency intends to disclose this information, or any part thereof, we request prior written statutory notice be given to Sparton of Canada, Limited, Attention: Manager Contracts, 99 Ash Street, London, Ontario, Canada, N5Z 4V3.

### **SECURITY**

SOC is an approved facility in accordance with DSS security requirements and staff have clearance to NATO SECRET as required.

1. **Project Summary**

In support of Sea Tech Inc., Sparton plans to develop a payload delivery system and commercial multi-function processor for an Expendable Optical Scattering/Temperature Depth Probe (XOTD). During the Phase II effort, Sparton will incorporate Sea Tech's optical scattering sensor into modified XBT-5 Bathythermograph hardware. Sparton currently manufactures all types of XBT's in production volumes, as well as a complete line of oceanographic products. The design goals for the XOTD are described in Table I.

	GOAL	
	ESSENTIAL	DESIRED
Probe Size and Weight	Similar to current XBT-5	
Full Depth (m)	200	300
Max Ship Speed (kts)	15	20
Descent Rate	Similar to XBT	
Optical Resolution (mV)	1	1
Accuracy (mV)	5	1
Temperature Accuracy	Same as XBT	
Depth Accuracy	Same as XBT	
Probe Activation	Sea water sense	
Uplink Data Format	3-12 bit words	8-12 bit words
Sample Rate (m)	0.5	0.2
Power	Internal Battery	
Shelf Life (years)	2	5
Cost(USD)*	<100	<79

(\*in mature, volume production)

Table I  
XOTD Preliminary Design Goals

Several prototype sensors will be built for development of the XOTD. These sensors will be tested both in the laboratory and the field. The final results of probe design and test data will be published in a final report.

2. **Identification and Significance of the Problem or Opportunity**

The XOTD and variants will have significant Naval applications. In supporting efforts related to non-acoustic ASW. The development of LIDAR's as an ASW tool will require XOTD information to perform range prediction calculations, much like AN/SSQ-36 is used currently. The XOTD could also be used to determine optical propagation for optical communications with or from submarines or other submerged platforms for sea, air or space borne communications.

In the open ocean, the XOTD could be configured to acquire ambient optical propagation data much like drifting buoys are utilized today. While in the Arctic, efforts are currently underway to develop an Arctic Oceanographic Buoy, the buoy is being developed as a platform for deploying sensors through 3 meters of Arctic ice and delivering the data to a satellite. This buoy could be adapted to deploy the XOTD.

Since the probe will be used in an expendable fashion, cost will be a major factor in maximization of the benefit to both the Oceanographic and Naval communities. Therefore, emphasis will be placed on the design to cost goals during the Phase II program. Of particular importance to the Naval community will be compatibility with existing systems. Therefore, the probe will be configured for use, storage and handling in similar fashion to current XBT and AXBT stores.

Modification to airborne processor software will be limited to graphic information display. While the multi-function processor card will be compatible with all current ship launched expendable inventory. The multi-function card will be designed for simple interfacing with future probe variants. The card will thus provide the user with a single data collection platform and will ease the introduction of future probe variants, since only a software update will be necessary.

### 3. Phase II Technical Objectives

The objectives of the Phase II effort for Sparton of Canada will be to demonstrate operation of advanced models of the deployment vehicle to the preliminary design goals (see Table I), and the operation of a multi-function processor, as specified in the Statement of Work (SOW). The major tasks in the SOW are:

- 1) XOTD Probe
- 2) XOTD Tests
- 3) XOTD Manufacturing concerns
- 4) Multi-function Processor
- 5) XOTD Launcher concerns
- 6) Program Management

### 4. Statement of Work

This following discussion outlines the major work activities for this program. Figure 1 provides a milestone schedule for the program.

#### ONR - XOTD - Ship Launched Expendable Optical/Temperature Probe (8007.B0)

##### XOTD - Probe (8007.B1)

**Electrical** - SOC will evaluate telemetry electronics designed by Sea Tech. Field tests will be carried out to determine optimum probe electronics for the optical/temperature sensors. Design and selection of batteries and seawater switch will be conducted. It is anticipated that the lower electronics circuit board will require significant size reduction and cost reduction analysis. In order to achieve the required cost/size reduction for eventual volume manufacturing a hybrid or ASIC circuit may be required.

**Mechanical (8007.B4)** - Effort will be required to house the optical sensor and associated electronics, batteries and seawater switch into the present XBT probe body. Particular attention will be made to the packaging concept in order to simplify assembly and test of the overall XOTD probe. Overall, end unit cost and unit performance will dictate approach taken. The present concept is to modify the lower spool and extender tube of the XBT-5. Using a modified short depth spool and longer outer shell, sufficient volume should be left to accommodate previously mentioned XOTD components. The level of effort included in this activity will include detailed design up to and including modification of XBT tooling for use in prototype manufacturing.

**Hydro Analysis (8007.B5)** - It will be necessary to characterize the descent rate of the present XBT probe and subsequent optical sensor embodiment. As well, it will be necessary to ensure that optical sensor placement into the XBT probe body is accomplished at a point where minimal turbulent water flow exists. To aid in this work effort Sea Tech will arrange fluid dynamics testing and characterization analysis. This work will be subcontracted to an agency, whose facilities and personnel have expertise in these areas. The results of the hydro analyses will be made available to SOC.

**XOTD - Tests (8007.B2)****XOTD Lab Tests (8007.B6)**

**Shock/Vibration (8007.BC)** - SOC will build and then test a quantity of six (6) XOTD units according to MIL requirements for shock and vibration. Some of these tests may be carried out at the Sparton ASWTC in Jackson Michigan. The purpose of this test is to confirm design integrity of the XOTD when subjected to military specified levels for shock and vibration. If required design changes will be made.

**Hot/Cold (8007.BD)** - SOC will build and then test a quantity of six (6) XOTD units according to MIL requirements for hot (+71°C storage, +55°C operational) and cold (-55°C storage, -20°C operational). These tests will be carried out at SOC. The purpose of this test is to confirm design integrity at these temperature extremes, which will likely be required for eventual military markets. If required design changes will be made.

**Field Tests (8007.B7)**

**Engineering Tests (8007.BE)** - SOC will carry out an engineering level test of 12 XOTD models. Assistance by Sea Tech personnel is expected. Sea Tech will also provide an oceanographic instrumentation package which is to provide comparison measurements for light transmission, light scattering, depth, and temperature. The XOTD engineering models will be hand launched over the side. Testing will be conducted under tow and at rest (zero velocity). These models will be built using hand modified parts either from standard XBT or made by a machine shop. The purpose of this test will be to verify an integrated XOTD design concept and identifying further design changes that may be necessary. Some parameters that will be evaluated will be optical scattering accuracy, repeatability, linearity, resolution, and hard wired telemetry operation. As well, SOC will evaluate the accuracy of the temperature sensor portion of the XOTD. An estimate of future temperature accuracy will be made. Additionally particular attention will be made to the probe hydrodynamic stability and suitability of sensor location. The test data will be supplied to Sea Tech for comparison of optical scattering data.

**Prototype Test (8007.BF)** - SOC will carry out field testing of 24 prototype XOTD probes. Assistance by Sea Tech personnel is expected. Sea Tech will also provide an oceanographic instrumentation package which is to provide comparison measurements for light transmission, light scattering, depth, and temperature. The purpose of this test will be to ship launch prototype XOTD probes, gather optical scattering and temperature profiles versus depth and evaluate the results against non-expendable sensors. Some parameters that will be evaluated will be optical scattering accuracy, repeatability, linearity, resolution, and hard wired telemetry operation. Post test analysis will be carried out by SOC and Sea Tech personnel whereby a detailed analysis of all test data and hardware will take place. SOC will make all test arrangements. Due to the experimental nature of the test, a second prototype test will very likely be carried out.

**Preproduction Test (8007.BG)** - SOC will carry out field testing of 72 preproduction XOTD probes for field testing. Assistance by Sea Tech personnel is expected. Sea Tech will also provide an oceanographic instrumentation package which is to provide comparison measurements for light transmission, light scattering, depth, and temperature. The purpose of this test will be to hand launch preproduction prototype XOTD probes and compare test results to non-expendable optical and temperature standards. Parts used for these probes will be made from tooled parts designed for the XOTD. SOC will arrange all testing. Post test analysis will be significant and will concentrate on comparing the XOTD probes optical scattering and temperature data against non-expendable sensors to determine accuracy, resolution and overall repeatability of XOTD probe operation. A second preproduction test will very likely be carried out.

### **XOTD Manufacturing (8007.B3)**

**Test Equipment (8007.B8)** - SOC will design and implement all necessary test equipment for the XOTD probe. All test equipment employed will utilize similar philosophy to that presently used for XBT. This methodology employs minimal operator wait time, simple calibration and facilitates statistical process monitoring. An overall XOTD product specification will be written to outline operating limits to be used as a guide to prepare test procedures and methods. Significant interaction with Sea Tech is expected, to decide on a preferred approach to setup and calibrate the optical scattering sensor and associated electronics. Specific test stations that will be required include: optical setup and calibration, and prepot operational tester.

**Jigs and Fixtures (8007.B9)** - Some prototype manufacturing aids will be required to ensure repeatable and efficient assembly of the XOTD. A number of jigs and fixtures presently used on the XBT production line will be used. However, for the XOTD the following will be required: optical sensor and board potting fixtures, battery and seawater switch mounting and assembly fixtures.

## **ONR - Processor - Multi-function (Optical/Temp.) Processor (8007.C0)**

**Processor Hardware (8007.C1)** - SOC will evaluate the design provided by Sea Tech, and other concepts having at least 12 bit accuracy for the Processor front end hardware design. Trade offs will be made dependent on hardware performance and cost benefit analysis. The purpose of this activity is to evaluate hardware concepts and then implement into the present SOC processor unit. Careful attention will be paid to worst case analysis of circuit operation, for example: temperature/CMR/CMV extremes.

**Processor Software (8007.C2)** - SOC will rewrite certain sections of the present Processor card software to incorporate both AXOTD and XOTD features. In order to incorporate into the present processor, SOC will evaluate the Sea Tech design and if possible utilize their algorithms. Full inclusion into the SOC processor will require modification to both the low level (processor) and high level (personal computer) code. Evaluation and then implementation of parameters such as file storage, graphics display, and menu selection will all be addressed.

**Aircraft Receiver Interface (8007.C3)** - To simplify operation of the processor for use with air launched (VHF linked) OTD's, SOC proposes to investigate incorporating a receiver into the processor. SOC will evaluate present A/C sonobuoy receivers and other commercially available ones to examine (more in depth) difficulty with this embodiment. If time permits, SOC will incorporate a breadboard design into the field test processor unit.

**Integrate Processor (8007.C4)** - SOC will incorporate the AXOTD and XOTD features into the processor card design. This effort will involve a number of configuration changes. Some activities will be to relayout the processor circuit board and prepare all other drawings required for eventual assembly of the processor card.

**Processor Tests (8007.C5)**

**Lab Test(8007.C7)** - SOC will build a laboratory bench test processor card complete with the associated changes for the AXOTD and XOTD. The purpose of this test is to subject the processor card to many of the critical operational parameters in a controlled way, and evaluate its performance during these scenarios. If performance deficiencies are noted, then changes will be made to the design. Some specific parameters being tested are: hot/cold, shock/vib. common mode voltage and common mode resistance.

**Field Tests (8007.C8)**

**Engineering Test (8007.CA)** - After incorporating changes from the bench testing, SOC will then build another processor card to be used on an engineering field test. The purpose of this test is to evaluate performance of the processor card during coincidental AXOTD/XOTD tests. Plans are to plug the processor card into a portable personal computer and interface directly with either the hand launcher for ship launched or to the aircraft receiver for air launched. Performance deficiencies will be noted and corrected.

**Prototype Test (8007.CB)** - SOC will supply and test a processor unit during the prototype field tests.

**Preproduction Test (8007.CC)** - SOC will supply and test a processor unit during the preproduction field tests.

**Processor Manufacturing (8007.C6)**

**Test Equipment (8007.C9)** - SOC will design all necessary test equipment for the processor card to be used in prototype manufacturing. An overall processor card product specification will be written to outline the operating limits to be used as a guide to prepare test procedures and setup methods. Special effort will be made to employ a method of self calibration with an interactive test/setup station.

**ONR - Launcher (8007.D0)**

**Launcher Compatibility (8007.D1)** - SOC will carry out an investigation of the variety of industry standard launchers that will likely be used for XOTD and AXOTD. During this investigation, SOC will verify that precautions to ensure full compatibility and interoperability are taken.

**NOARL / ONR - Program Management (8007.E0)**

**Design Review Meetings (8007.E2)** - SOC will host five (5) design review meetings at our facilities in London, Ontario, Canada. The suggested dates for the design reviews are: 15 May 1992, 01 August 1992, 01 March 1993, 01 September 1993 and 01 March 1994. Final date selection will be agreed upon by SOC and Sea Tech. The purpose of these design review meetings will be to review progress to date on the AXOTD, XOTD and Processor developments and discuss upcoming activities.

**Monthly Reports (8007.E3)** - SOC will submit monthly progress reports to Sea Tech. The purpose of these monthly reports is to discuss program progress over the past month and support anticipated progress billings. These reports will provide a brief overview of the programs, and give a report of technical achievements. The first monthly report will occur 30 days after contract award (expected 31 March 1992), and the last will occur one month before the final report (expected 31 January 1994).

**Final Report (8007.E4)** - SOC will submit a final report detailing the AXOTD and XOTD programs. Specific attention will be made to the designs, their operation and documentation. In the body of the report, SOC will provide outline drawings of the AXOTD and XOTD. As well, SOC will review all significant laboratory and field testing including test results, failure analysis and corrective action implementation. The final report(s) will be submitted no later than 31 March 1994.

**Program Manager (8007.E1)** - SOC will assign a program manager (tentatively G. Keogh) to the AXOTD/XOTD programs. The program manager will have full responsibility for program schedule, cost and technical compliance. The program manager will be the main point of contact with Sea Tech. The program manager will assemble the project team members, structure work assignments, and motivate this team to meet customer requirements.

Date: 02/24/92		Page 1 / 1		Project Finish: 03/31/94		SCHEDULE AXOTDXOTD ONR		Legend																															
8007																																							
Network Name	Activity Name	Early Start	Activity Code 1	1992												1993												1994											
ONR	ONR START	03/02/92	8007.A0.03	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J																	
ONR	field test Tolern	04/14/92	8007.A0.48																																				
ONR	des rev 1	05/15/92	8007.A0.01																																				
ONR	fld test eng xot	06/30/92	8007.A0.07																																				
ONR	des rev 2	09/03/92	8007.A0.04																																				
ONR	proto test xot	02/01/93	8007.A0.08																																				
ONR	des rev 3	03/01/93	8007.A0.05																																				
ONR	des rev 4	09/01/93	8007.A0.06																																				
ONR	prod test xot	11/01/93	8007.A0.11																																				
ONR	des rev 5	03/01/94	8007.A0.07																																				
ONR	FIAM REPORT	03/31/94	8007.A0.17																																				
ONR	ONR FINISH	03/31/94	8007.A0.02																																				

Figure 1

## 5. Related Work

Sparton of Canada has been building sonobuoys since the 1950's and has been involved in almost every major Canadian sonobuoy development program, since their inception.

### 5.1 Air Launched Bathythermographs

Sparton of Canada is currently the principal manufacturer of air launched bathythermographs, and built 80% of the world requirements in 1989. Sparton also recently won a competitive contract from the USN to develop an 800m AN/SSQ-36.

During the original development of the AN/SSQ-36, Sparton underwent a full Test Analyze and Fix (TAAF) program, and is the only sonobuoy manufacturer to have completed such a program. Sparton has built and delivered over 41,000 AN/SSQ-36 buoys. Quality control of the product has been such that Sparton received Skip Lot acceptance. Skip Lot acceptance is granted by the USN to sonobuoy manufacturers when excellent quality has been demonstrated over a period of time. Sparton has also been involved in the improvement and refinement of the product which would permit downsizing of the buoy to a "force launch", "A/2" size. The program will involve strict design to cost targets, which Sparton is able to meet. Sparton has also developed a gravity launched "A/3" version for the U.K. and has tested units successfully at the British Sonobuoy test range. In anticipation of these programs, Sparton originally developed the buoy in the "A/3" size, using ballast and air to complete the "A" size package.

### 5.2 Ship Launched Bathythermographs (XBT)

Sparton also developed an XBT to compete with the current sole source manufacturer. Sparton is the only successful competitor for the manufacturer, who has been building the probes for 20 years. The Sparton probe is currently in high volume production. It has developed a record for high reliability and has been formally qualified by the Canadian Navy. Strict design to cost goals were set and met during the development.

Sparton has developed unique variants of the probe including a 1000m version which is housed within the standard size probe assembly. The development took place in support of the Oceanographic communities need for an extended depth XBT-7. The probe has been successfully tested in small quantities by SCRIPPS.

### 5.3 Submarine Launched Expendable Bathythermograph (SSXBT)

Sparton is developing an SSXBT to provide naval forces with a more competitive product. Development and certification are planned for completion in June 1992.

**5.4 Acoustically Linked XBT**

Sparton is working with the University of Rhode Island on a program to develop a deeper depth acoustically linked XBT for use to 6000m. The anticipated program would require the integration of an acoustic transponder resonant at 18 KHz into the probe and development of a receiver/decoder which interfaces with existing ship fathonometers.

**5.5 Expendable Ship Launched Sound Velocimeter (XSV/AXSV)**

Sparton has teamed with a small firm to develop an Expendable Sound Velocity Sensor. The sensor will be compatible with existing XSV sensors but will provide a more cost effective package. Major design goals during the development are to increase reliability and shelf life. The sensor will consist of dual high frequency transducers utilizing the "sing around" principle and the probe will maximize the use of surface mount technology. The XSV will have a self contained power source, and will therefore be similar in function and design to the planned XOTD. Our success with working with smaller firms on joint efforts has been well demonstrated during the Phase I program.

**5.6 AXBT/XBT/XSV Card Based Processor**

During the AXBT and XBT, Sparton developed a user friendly XBT/XSV/AXBT Processor. The processor consists of a PC based card which can be installed in the expansion slot of an IBM compatible computer. The Processor Card would form the baseline for this effort.

**5.7 Arctic Oceanographic Buoy**

Sparton is currently under contract with NOARL to develop an Arctic Oceanographic Buoy. The AOB program was based on successful results from the development of an Ice Penetrating Sonobuoy for the Defence Research Establishment, Pacific. During this program, hand emplaced units were built and demonstrated concept feasibility using a family of environmentally safe thermochemicals. The AOB will be a 90 day ARGOS Satellite transmitting buoy capable of penetrating 3 meters of first year ice. In the Initial Operational Configuration, the buoy will deploy a hydrophone which will collect ambient noise from 5 Hz to 5 kHz in one third octave bands. The buoy will also send back a reading of the actual ice thickness. Other future variants will include thermistor chains, XSV's, XCTD's, etc. The AOB could be modified to accept the XOTD.

**5.8 Conclusion**

Sparton of Canada has a demonstrated capability to meet new product development objectives and is currently involved in the development of several types of Expendable Oceanographic Probes with associated equipment. The related experience will provide multiple uses and platforms for the XOTD. The experience in design to cost will provide a high confidence that the production version of the probe will be such that it becomes a useful tool for the Oceanographic and military communities.

## 6. Potential Applications

The following potential applications are summarized from Section 2.0:

- a) Support of Planned Fleet Numerical Optical Oceanographic Databases (XOTD/AXOTD)
- b) Support of LIDAR Operations to increase effectiveness of LIDAR non-acoustic ASW Systems
- c) Support Optical Underwater Communications

The development of a commercial multi-function processor card will greatly increase efficiencies during oceanographic cruises by providing the user with a single platform for the collection of all types of expendable probes. Simplified data storage and system operations software will reduce training requirements. Overall the card will reduce data acquisition costs by multi-tasking a standard computer for current and future probe variants.

## 7. Relationship with Future Research and Development

Sparton has made a commitment to the development of new types of Oceanographic probes. The goal of Sparton's efforts are to produce expendable sensors at the lowest possible cost and with the greatest amount of compatibility to existing hardware. The objectives combine to provide three major benefits; a) reduced development costs through the use, where possible, of existing hardware, b) minimum integration costs to existing platforms and systems, and c) part compatibility ensuring the highest possible production volumes.

Sparton has undertaken a series of future developments, which will be both internally and externally funded. Some of these efforts have been outlined in section 5.0. For the Phase III program, Sparton has set aside up to \$300,000 over two years to continue the development and make the probe commercially available. This self commitment program would begin around July, 1993.

## 8. Key Personnel

The organizational structure at SOC is given in Table II.

The Program Manager for Sparton of Canada will be Mr. Gerry Keogh and the work will be conducted within Sparton's Engineering Department, direction by Mr. Gerry Keogh.

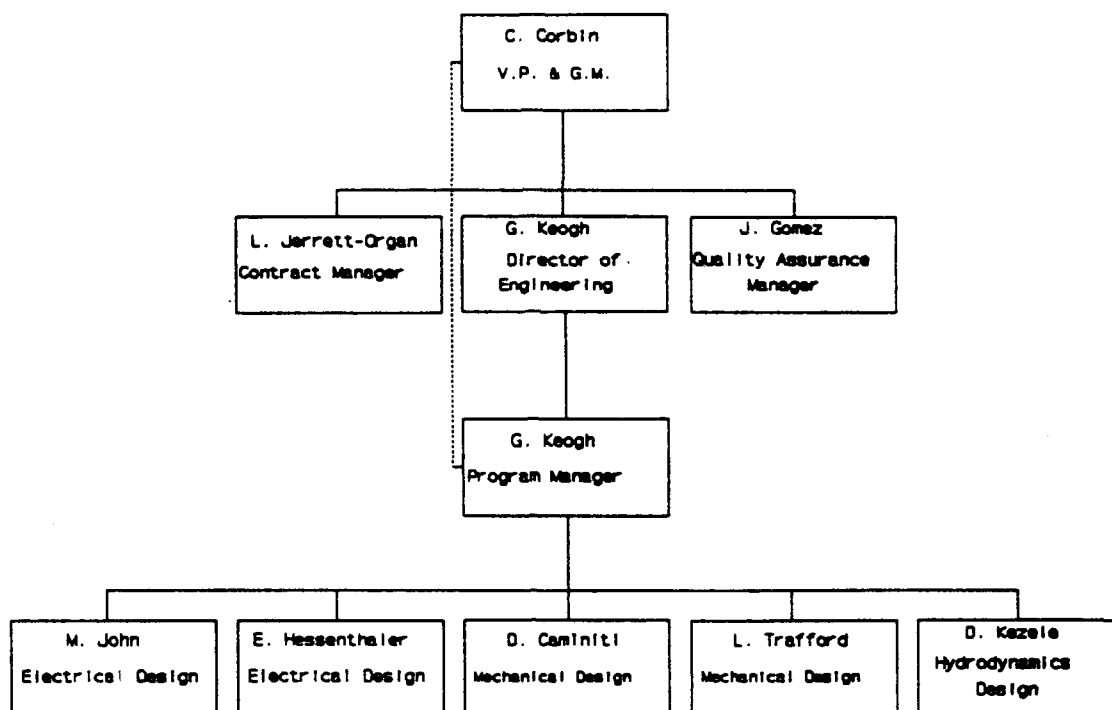


Table II

## 9. Facilities/Equipment

### 9.1 Engineering Capabilities

SOC's Engineering Department is comprised of professionals of all disciplines engaged in research, development, design, and testing of a range of sonar devices, sonobuoys, and signal processing equipment for Canadian DND, U.S. DoD, and Allied defence agencies. The Engineering Department is responsible for the development of the Q-36/Q-536 Bathythermograph buoys, the XBT ship launched bathythermograph, associated processors, miniature (Microbuoy) sonobuoys, RSP's and other Low Frequency Active transducers and transducer systems for the Canadian Government.

## 9.2 Engineering Facilities Overview

SOC's Administrative, Engineering and Manufacturing operations are incorporated in a modern plant at London, Ontario, and the main resources include the following:

- a) **Hydroacoustic/Hydrodynamics Test Tank.** The hydroacoustics/ hydrodynamics test tank is used in development work and production testing. It is 40 ft. in length, 20 ft. wide and 20 ft. deep. Acoustic baffles are placed on the inner concrete walls and floor of the tank to absorb reflected sound. A fixed gantry and overhead trolley with an electric chain hoist permit easy deployment of apparatus into the tank. Tow tests on deployed bodies are performed under computer control.
- b) **Pressure Vessel.** A 1000 psi hydro pressure vessel is also at the facility. The clam-shell door of the spherical pressure chamber allows complete access to the interior which can accept objects over 5 feet in diameter. The chamber is sealed by means of hydraulically activated rams and additional mechanical safety fasteners.  
  
Testing can be conducted at pressures encountered at the normal operating depths or survival depth of the unit under test to verify seal integrity and measure electrical parameters. This ensures compliance with specifications.
- c) **Model Shop.** A fully equipped model shop produces numerous mechanical parts required for projects. Jigs, fixtures, and prototype/production components are also manufactured to meet close tolerance standards.
- d) **Environmental and Non-Operating Test Facility.** A fully equipped facility is available for Environmental and Non-Operating Tests at the Sparton Jackson (Michigan) ASW Technical Center. Humidity Chambers, Temperature Cycling Chambers, a 2 Axis Vibration Table, a Centrifuge, Vacuum Chambers, and a 100 g Shock Table are all located at this facility.
- e) A full range of the normal electrical, electronic and mechanical test equipment is also available, as is an extensive network of personal computers, and a microvax super mini computer.

These facilities allow for ongoing electrical/mechanical design development, manufacturing support, critical component testing, environmental testing, and assembly. Total control is thus assumed over the major activities concerned with the design and custom assembly of projects undertaken.

### 9.3 Manufacturing Capabilities

SOC's manufacturing reputation is built on delivering high quality military products on time. From the time the order is released to when the product is shipped, manufacturing responds in a smooth flow. Material control and production planning are controlled by a computerized MRP II system which keeps track of all material transactions. The buyers in the purchasing department are familiar with the requirements of military contracts. The incoming inspection area utilizes various jigs, fixtures, and equipment to monitor received materials. The manufacturing engineers have both high volume manufacturing experience, as well as small batch production methods. the skilled labour force has many years of experience in building products to high quality standards.

Manufacturing operations on the shop floor are performed on continuous flow assembly lines. Specific expertise exists for winding, ceramic assembly, epoxy coating, urethane coating, grinding, soldering, and electronic assembly and test. Inspection is based on SPC principles. The manufacturing facility is modern and air conditioned. Strict environmental controls are in place for operations where operator safety or the environment is concerned. Manufacturing operations are supported by a test equipment department where much of the test equipment that is used in manufacturing is fabricate<sup>d</sup>.

These key areas combined provide SOC with an exceptional manufacturing capability and expertise in military products.

APPENDIX "A"

RESUMES

## RESUME

**FULL NAME** Gerald Peter Keogh

**JOB TITLE** Director of Engineering

**EDUCATION** Catholic Central High School, London, Ontario  
Completed 5 year Maths & Science Programme (1969 - 1974)

Fanshawe College, London, Ontario, completed Electronics Engineering Technician Programme, as well as courses towards Technologists Degree (1974 - 1976)

O.A.C.E.T.T. completed courses up to Technologist level (1978 - 1983)

Pursuing APEO recognition and B.E.Sc. degree and E.E.Sc. degree

### Intensive Short Courses

I.E.E.E. short course on micro-computers

Short course on Switch Mode Power Supply Design by Phillips (1980)

Unitrode short course on Switchmode Power Supply Design (1983)

Six day course on DC Power Converter Design, lectured by Dr. F. Lee, Rudy Severns, Col. Wm. McLyman (1984)

Course of "FAST ALGORITHMS" for Digital Signal Processing, presented by The International Defence Electronics Association (1986).

Unique Management Skills Training Course, Sparton (1989)

**EXPERIENCE** Sparton of Canada, Limited (July. 1989 - present)

Responsible for:

- Administration of Engineering Department
- all aspects of project performance through intermediate Engineering Managers
- Operating and Capital Budgets
- Short and long term facilities planning
- Engineering manpower

Sparton of Canada, Limited (October 1985 - July 1989)  
Manager Advanced Development and Support Group

Responsible for:

- managerial responsibility for advanced development and support group
- Project Leader on Microbuoy Transportable Test Facility Project (MTTF)
- Project Leader on Bathythermograph Buoy Project (AXB/T/XBT)
- Project scheduling, costing and proposal writing for new business opportunities

Sparton of Canada, Limited (September 1983 - October 1985)

Power Supply Designer

Responsible for:

- research and design/development of switching mode power supplies for commercial and military markets
- senior designer responsible for designing and supervision of a team of engineers on various power supply projects.

Photochemical Research Associates Inc., London, Ontario  
(1976 - 1981) (1982 - 1983)

Design Technologist

- Responsible for design/development of various power supplies including 1KW linear power supply and 500W and 300W high frequency switching supplies
- also designed laser type power systems for pulsing high voltage applications

Northern Telecom, London, Ontario (1981 - 1982)

Design Technologist

- member of design control team for advanced key telephone systems. Areas of major responsibility were switch mode power supply and micro-processor phone technology

**PROFESSIONAL PUBLICATIONS**

Final Report - Switch Mode Power Supply, TRL 86-07,  
MARCH 1986 with Sami Kutlug

**Final Report - AN/SSQ-536/Q36 TAAF Design,  
Performance Test Survey**

**PROFESSIONAL AFFILIATIONS**

Member of Ontario Association of Certified Engineering  
Technicians and Technologist (OACETT)

I.E.E.E. Lecturer on switchmode power supply design

Partial load instructor at Fanshawe College of Applied  
Arts and Technology, London, Ontario.

**PERSONAL** Place of Birth: Toronto, Ontario

Citizenship: Canadian

Security Clearance: Secret, NATO

Keogh/FEB. '87

xxx

## **Appendix B**

**SPARTON  
OF CANADA LTD.**P.O. Box 5125  
LONDON, CANADA N6A 4N2  
(519) 455-6320**ORIGINAL INVOICE**

<b>SOLD TO</b>	Sea Tech Inc., P.O. Box 779 Corvallis, OR 97339	OUR ORDER NO.
		YOUR ORDER NO.
<b>SHIP TO</b>		SHIP WHEN
		TERMS Net 30 Days
		F.O.B. OUR PLANT
<b>PPD</b>	<b>REQUESTED ROUTING.</b>	<b>COLL.</b>

27063		<b>INVOICE NUMBER</b>
<b>INVOICE DATE</b> February 28, 1992	<b>DATE SHIPPED</b>	
<b>BILL OF LADING NO.</b>		
<b>SHIPPED VIA</b>		
<b>NO. OF PKGS</b>	<b>WEIGHT</b>	

QTY	PART NO.	DESCRIPTION	PRICE	QTY. SHIPPED	NET
		Payment # 1 For February 28, 1992  Progress Report Attached  Subcontract No. C ONR/EPS2S          Job 8007			\$32,500.00          US Funds
				<b>TOTAL</b>	<b>\$32,500.00</b>

**SPARTON  
OF CANADA LTD.**P.O. Box 5125  
LONDON, CANADA N6A 4N2  
(519) 455-6320**ORIGINAL INVOICE**

<b>SOLD TO</b>	Sea Tech Inc., P.O. Box 779 Corvallis, OR 97339	OUR ORDER NO.
		YOUR ORDER NO.
<b>SHIP TO</b>		SHIP WHEN
		TERMS Net 30 Days
		F.O.B. OUR PLANT
<b>PPD</b>	<b>REQUESTED ROUTING.</b>	<b>COLL.</b>

27063		<b>INVOICE NUMBER</b>
<b>INVOICE DATE</b> February 28, 1992	<b>DATE SHIPPED</b>	
<b>BILL OF LADING NO.</b>		
<b>SHIPPED VIA</b>		
<b>NO. OF PKGS</b>	<b>WEIGHT</b>	

QTY	PART NO.	DESCRIPTION	PRICE	QTY. SHIPPED	NET
		Payment # 1 For February 28, 1992  Progress Report Attached  Subcontract No. C ONR/EPS2S  <div>DECLUTED TAGS C SPARPO 100 C/ANALOG 100 C 100 C</div>  Job 8007			\$32,500.00
				<b>TOTAL</b>	<b>\$32,500.00</b>

US Funds

**SPARTON  
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LONDON, CANADA N6A 4N2  
(519) 455-6320

EXTRA

**ORIGINAL INVOICE**

<b>SOLD TO</b>	Sea Tech Inc., P.O. Box 779 Corvallis, OR 97339	OUR ORDER NO.	INVOICE DATE February 28, 1992		DATE SHIPPED	INVOICE NUMBER 27063
		YOUR ORDER NO.				
<b>SHIP TO</b>		SHIP WHEN	BILL OF LADING NO.			
		TERMS Net 30 Days				
		F.O.B. OUR PLANT	SHIPPED VIA			
<b>PPD</b>	<b>REQUESTED ROUTING.</b>	<b>COLL.</b>	<b>NO. OF PKGS</b>	<b>WEIGHT</b>		
<b>QTY</b>	<b>PART NO.</b>	<b>DESCRIPTION</b>	<b>PRICE</b>	<b>QTY. SHIPPED</b>	<b>NET</b>	
		Payment # 1 For February 28, 1992  Progress Report Attached  Subcontract No. C ONR/EPS2S          Job 8007			\$32,500.00	
				<b>TOTAL</b>	<b>\$32,500.00</b>	

US Funds

**PROGRESS REPORT**  
**FEBRUARY 1992**  
**TO**  
**SEA TECH**  
**FOR**  
**DEVELOPMENT OF**  
**EXPENDABLE SHIP LAUNCHED OPTICAL SCATTERING PROBE (XOTD)**  
**FROM**  
**SPARTON OF CANADA LTD.**

**Reference :**    **ONR Contract #**    **N00014-91-C-0123**  
                  **Sea Tech Contract #** **ONR/EPS2S**  
                  **SOC Job 8007**

**By : G. Keogh**  
**Date : 02 March 1992**

## February 1992 Progress Report

### 1.0 During the month :

During the month of February 1992, Sparton of Canada Ltd. (SOC) began development work on the XOTD. Initial technical discussions with Sea Tech personnel Bob Bartz and Jeff Mather were carried out. The purpose of these conversations was to have Sea Tech explain in detail the operation of the optical scattering sensor. Additionally Sea Tech explained their design concepts for the data telemetry and acquisition systems. SOC and Sea Tech personnel carried out basic bench testing of proposed circuitry connected to SOC AXBT hardware. This test allowed initial evaluation of the Sea Tech data telemetry scheme using actual wire spools and interaction with a standard sonobuoy type modulator/transmitter set. This test successfully demonstrated a wireless communication link from the optical scattering sensor to a remotely positioned receiving system. Obviously this test is only a first try and conducted in somewhat ideal laboratory conditions, but proves that the Sea Tech schemes are functional enough for further tests and cost benefit analysis.

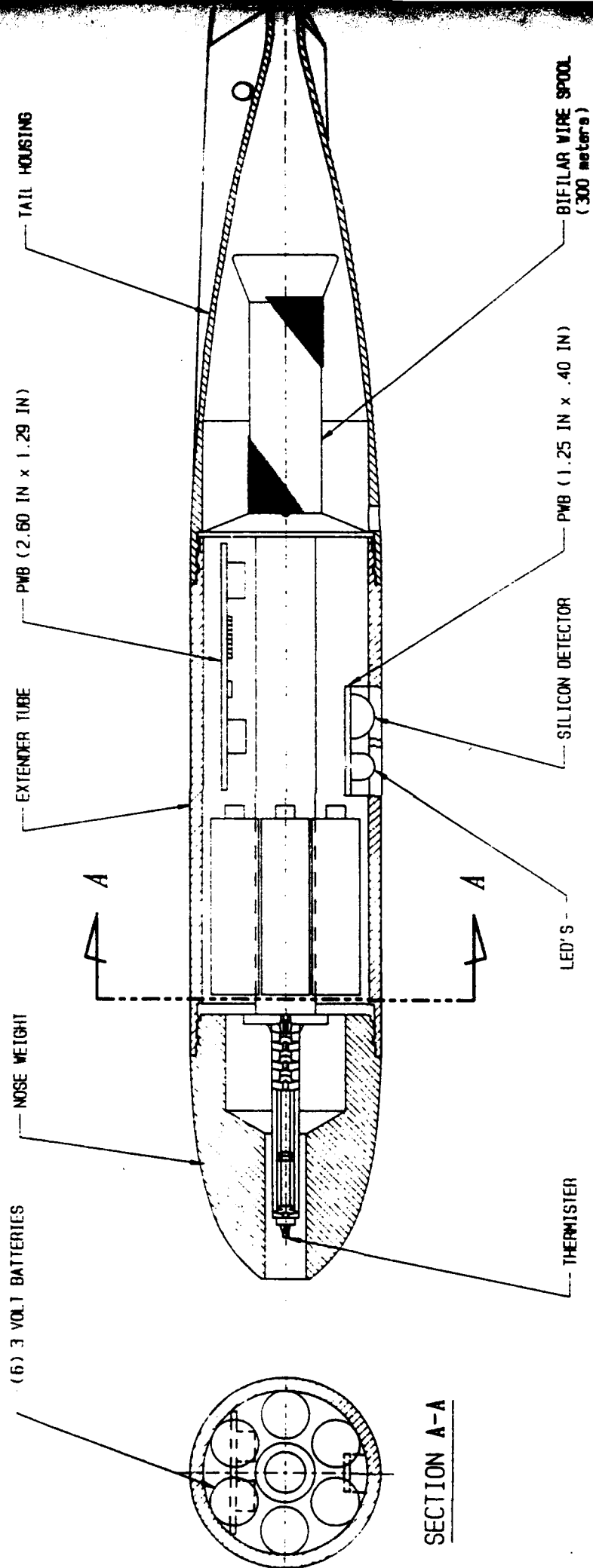
Other activities also initiated during February 1992 were evaluation of overall XOTD packaging concerns. Main areas were those related to battery selection, sensor packaging and placement, concepts for standard XBT modification to house XOTD components. Refer to figure 1 to see the present packaging concept.

### 2.0 Upcoming Activities :

Some areas planned for March 1992 are to begin the hydrodynamic analysis work. A outside consultant group will be identified to carry out this work under the direction of SOC. The purpose of this analysis will be to select the optimum position for the optical sensor in the standard XBT body.

Efforts will begin during March 1992 to plan for the first field test. This prime reason for this test will be to evaluate data telemetry options.

# XOTD CONCEPT DRAWING



SECTION A-A

- NOTES:
- USE STANDARD TAIL HOUSING
  - USE STANDARD XBT-5 EXTENDER TUBE
  - ESTIMATE OF ADDITIONAL MASS DUE TO BATTERIES AND PWB'S IS LESS THAN .426 grams.

[illegible]

**SPARTON**  
**OF CANADA LTD.**P.O. Box 5125  
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EXTRA

## ORIGINAL INVOICE

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		YOUR ORDER NO.			
<b>SHIP TO</b>		SHIP WHEN	INVOICE DATE	DATE SHIPPED	
		TERMS Net 30 Days	March 31, 1992		
		F.O.B. OUR PLANT	BILL OF LADING NO.		
PPD REQUESTED ROUTING. COLL.			SHIPPED VIA		
			NO. OF PKGS	WEIGHT	

QTY	PART NO.	DESCRIPTION	PRICE	QTY. SHIPPED	NET
		Payment # 2 For March 31, 1992  Progress Report Attached  Subcontract No: C ONR/EPS2S.          Job 8007			\$32,500.00
				TOTAL	US Funds \$32,500.00

QTY	PART NO.	DESCRIPTION	PRICE	QTY. SHIPPED	NET
		<p>Payment # 2 For March 31, 1992</p> <p>Progress Report Attached</p> <p>Subcontract No: C ONR/EPS2S.</p> <p><i>[Handwritten signature]</i></p> <p>Job 8007</p>			<p>\$32,500.00</p> <p>US Funds</p>
				TOTAL	\$32,500.00

PROGRESS REPORT  
MARCH 1992  
TO  
SEA TECH  
FOR  
DEVELOPMENT OF  
EXPENDABLE SHIP LAUNCHED OPTICAL SCATTERING PROBE (XOTD)  
FROM  
SPARTON OF CANADA LTD.

Reference :    ONR Contract # N00014-91-C-0123  
              Sea Tech Contract # ONR/EPS2S  
              SOC Job 8007

By : G. Keogh  
Date : 21 April 1992

### March 1992 Monthly Report for XOTD

During the month of March 1992 Sparton of Canada Ltd. (SOC) began assembly of the project team. The SOC project engineer is Mr. Erik Hessenthaler who will also be responsible for the electrical design aspects for the XOTD/AXOTD programs. Erik was involved in the initial discussions with Sea Tech at SOC during the program kick off. Erik's extensive experience in digital and analog circuit design and field testing will be a definite asset during these programmes. Erik will report directly to the Program Manager Mr. Gerry Keogh. Other team members involved only to a small extent at this point have been: Mr. Larry Trafford in mechanical design, and Mr. Linas Siurna in hydrodynamics.

Sea Tech identified a hydrodynamist at Johns Hopkins University (JHU) who would be a good candidate to carry out the planned probe analysis for optimum sensor placement. SOC and Sea Tech will visit JHU (Dr. Katz) to discuss project details and determine capabilities. Draft concept sketches for both XOTD and AXOTD probes were forwarded to Dr. Katz to permit review prior to any meeting.

Some further examination of the requirements to package the optical scattering sensor into the XBT or AXBT probe body was carried out. Concerns raised by Sea Tech regarding full depth (to 300 meters) sea water pressure and necessary optical properties are being addressed. One possible concept is to modify the present mould to selectively inject two small rectangular shaped "windows" into the probe body, carefully separated by a "light block". Information has been requested from plastics vendors regarding certain plastics optical properties. Due to the criticality associated with optical transmission, this information will be forwarded to Sea Tech after receipt for their review and approval prior to use. It is expected that optical attenuation, optical bandwidth among others will be important in this area.

SOC has begun planning for the first sea trial test. The purpose of this test will be to evaluate telemetry concepts for the XOTD/AXOTD probes. In order to select the final design concept it will be essential to characterize the XBT/AXBT spool wire. Knowledge of spool wire bandwidth and noise floor will help determine requirements for the telemetry scheme. One of the design concepts to be evaluated will be that provided by Sea Tech at the program kick off meeting. SOC is carrying out evaluation of other concepts. Very likely other designs will involve circuit simplifications from the Sea Tech unit, such as elimination of some filtering stages, or even possibly driving single ended as opposed to differential mode. SOC understands the importance of the XOTD/AXOTD performance during this phase of product development. Alteration of telemetry design from the Sea Tech approach will in no way degrade XOTD/AXOTD performance. At this point SOC expects that a tentative date for the test would be end May early June.

### **March 1992 Monthly Report for XOTD**

SOC expects that Sea Tech personnel will be available for this test and will provide oceanographic measuring equipment to compare results obtained.

During the months of April and May 1992 most of the planned work will involve identification of telemetry concepts and hardware models to be used for the upcoming field test. SOC will initiate actions with outside agencies to arrange facilities to carry out this test.

## **Appendix C**

```
{program to test interface to expendable scattering meter}
{revised 12/91,3/92 by JMM from MJB's 7/17/91 program}
```

**const**

```
iobase = $340; {we use addresses 340,341,342,343,344}
                                {our 8 bit comparator looks for 34x}
ctlReg = iobase+3; {our control word register has the address 343}
statByte = iobase+4; {address 344 lets us read from HC573}
```

```
type grpArray = array[0..1,1..3] of real;
```

**bt:byte;**

```
m,hour,minute,second,sec100,  
    oldhr,oldmin,oldsec,old100:word;  
tcount:array[1..2] of word;  
infreqs, volts:grparray;  
counttime,order,outidx,grpidx,group,chanpd,dcint,clockfreq:integer;  
incount:array[1..2] of integer;  
framesum:longint;  
fscale,f0,f5,ctimes: real;  
ctime: array[1..3] of real;  
outfile: text;
```

```
var i:Integer;
```

**begin**

**for i:=0 to 5 do i:=j:**

end;

**Procedure SetGateTime(counts:word); {set time that gate will be open}**

## Begin

```
port[ctlreg]:= $B2; {sets counter 2 to mode 1}
Delay(1); {allow for clock pulse necessary to set counter}
Port[iobase+2]:= counts and 255; stall; {least sig byte is remainder}
port[iobase+2]:= (counts div 256); stall; {most sig byte is quotient w/o
```

**the remainder}**

**End:**

**Function Freq: Real;** {determines frequencies of data}

```
var th,tl:array[1..2] of byte;
```

```

i:integer;

```

```
freq1,freq2:real;
```

## Begin

```

for i:=1 to 2 do {we get 2 counts in each channel}
begin
    {open the gate for preset time}
    port[iobase+4]:=0; {trigger the count}
    delay(dcint+3); {make sure gate is closed before reading counts,
                    allow for flip flop delay}

    {now get counts from counters}
    tl[i]:= port[iobase]; stall; {read LSB from counter 0}
    th[i]:= port[iobase]; stall; {read MSB from counter 0}
    tcount[i]:= 65536-(th[i]*256+tl[i]); {tcount is # of cycles of
    2 MHz clock}
    ctime[i]:= tcount[i]/(clockfreq/1000); {ctime is time we counted
    tcount/2MHz)
    is in usec}
    stall;
    tl[i]:= port[iobase+1]; stall; {read LSB from counter 1}
    th[i]:= port[iobase+1]; stall; {read MSB from counter 1}
    incount[i]:= 65536-(th[i]*256+tl[i]); {incount is # of
    cycles of data}
    end;

    freq1:=(incount[1]/ctime[1])*1e6; {freq from first count in Hz}
    freq2:=(incount[2]/ctime[2])*1e6; {freq from 2nd count in Hz}
    freq:=((incount[1]/ctime[1])*1e6+(incount[2]/ctime[2])*1e6)/2; {avg freq}

    if (freq1>freq2*1.1) then freq:=freq2;
        {if this is true, the first count counted an extra cycle}
    if (freq2>freq1*1.1) then freq:=freq1;
        {if this is true, the second count counted an extra cycle}

    counttime:= trunc(((ctime[1]+ctime[2])+500)/1000);
    {counttime is integer number of ms -- we round off ctime
    this is the actual gate width}

End;

Procedure FrameSync; {gets us to beginning of optical data channel
                     since HC123 goes low after 5 msec of no
input
                     pulses from wire, then goes high as soon as
data
                     is received}

var stime:integer;
Begin
    stime:= 0;
    Repeat
        Delay(1);
        inc(stime);
    until ((port[statbyte] and 2)=0) or (stime >200); {wait for sync low

```

```

                                we're in the sync
                                channel}
Repeat
    inc(stime);
    Delay(1);
until ((port[statbyte] and 2)=2) or (stime > 200); {wait for sync high

                                we're in optical
                                data channel}

end;

Function FrameInterval:integer; {determines the duration of a frame}
var ftime: integer;

Begin
    ftime:= 10;
    FrameSync; {wait for first sync pulse}
    Delay(ftime); {can't handle frame time less than 10 msec anyway}
    Repeat
        inc(ftime);
        Delay(1);
    until ((port[statbyte] and 2)=0) or (ftime > maxftime); {wait for

                                sync low}

    Repeat
        inc(ftime);
        delay(1);
    until ((port[statbyte] and 2)=2) or (ftime > maxftime); {wait for

                                sync high}

    FrameInterval:= ftime;
End;

Procedure ReadFreqs; {gets 6 frequencies in 2 groups of 3, one group is
                                {opt-temp-Vcc, the other is opt-temp-Gnd}
var i, dtime: integer;
Begin
    for group:= 0 to 1 do
        Begin
            FrameSync;
            delay(2);
            if (group=1) then begin
                oldhr:=hour; oldmin:=minute; oldsec:=second; old100:=sec100; end;
                gettime(hour,minute,second,sec100); {record time we get each group}

            for i:= 1 to 3 do
                Begin
                    infreqs[group,i]:= freq;
                    Dtime:=chanpd-(2*(dcint+3)); {get to beginning of next frame--

```

delay 3 ms longer than

remember the

gatetime

(twice), and the 3 ms delay}

if dtime > 0 then delay(dtime);

if dtime < 1 then

begin

gotoxy(1,14);

write('Counting close to edge of frame!'); {warn user if delay  
after gate closes extends into next frame}

end;

end;

end;

ctimes:=ctime[2]/1000; {ctimes is true gate width of GND or Vsupp}

End;

Procedure WriteGroup(gidx:integer); {writes frequencies to screen}

var i:integer;

Begin

for i:= 1 to 3 do

Begin

Write(infreqs[gidx,i]:8:1); {write frequency of each channel  
on screen}

End;

End;

Procedure WriteVGroup(gidx:integer);

var i:integer;

v,f: real;

Begin

write(hour:2,':',minute:2,':',second:2,':',sec100:2,' ');  
{display current time}

if (filewr='Y') or (filewr='y') then

if order=1 then write(outfile,hour:2,chr(9),minute:2,chr(9),  
second:2,chr(9),sec100:2,chr(9))

else write(outfile,oldhr:2,chr(9),oldmin:2,chr(9),oldsec:2,  
chr(9),old100:2,chr(9)); {write current time to file}

f:= infreqs[gidx,1]; {get optical frequency}

if fscale<>0 then v:=100\*(f-f0)/fscale {convert to % of full scale}

else begin gotoxy(1,25); write('Not Reading Data Correctly!'); end;

Write(v:8:4,' '); {write result on screen}

if (filewr='y') or (filewr='Y') then

begin

{ write(outfile,ctimes:8:2,chr(9)); } {write gatewidths to file}  
write(outfile,v:8:4,chr(9)); {write optical datum to file}

end;

f:= infreqs[gidx,2]; {get temperature frequency}

if fscale<>0 then v:=100\*(f-f0)/fscale {convert to % of full scale}

{ v:=-v\*1000/(v-(75+10)\*100/10)} {convert to

resistance}

```

else begin gotoxy(1,25); write('Not Reading Data Correctly!'); end;
write(v:8:4); {write result on screen}
if (filewr='y') or (filewr='Y') then
writeLn(outfile,v:8:4,chr(9)); {write result to file}
End;

```

```

Procedure WriteResults;
var i,j,grpidx,outidx:integer;

```

```

Begin
{find sync phasing so gnd is in freq 3 of first group
and vcc is in freq 3 of second group }
  grpidx:= 1;
  for i := 0 to 1 do
  begin
    j:= (i+1) and 1; {rolls over above 1}
    if (infreqs[i,3]>infreqs[j,3]) then grpidx:= i;
  end; {make grpidx the group with gnd}
  f0:= infreqs[grpidx,3]; {gnd is 3rd freq in the group}
  f5:= infreqs[(grpidx+1) and 1,3]; {vcc is 3rd freq in other group}
  fscale:=(f5-f0); {full scale, since data is between 0 and vcc}

  Gotoxy(1,5);
  outidx:= grpidx;
  WriteGroup(outidx); {write opt,temp, and gnd freqs on screen}
  Gotoxy(25,5);
  outidx:= (grpidx+1) and 1;
  WriteGroup(outidx); {write opt,temp, and vcc freqs on screen}
  gotoxy(63,8);
  write(ctimes:8:2,' ms'); {display measured frame widths on screen}

  Gotoxy(1,11);
  outidx:= grpidx;
  if outidx=0 then order:=0 else order:=1;
  WritevGroup(outidx); {do writevgroup for first group}
  Gotoxy(1,11);
  outidx:= (grpidx+1) and 1;
  if outidx=1 then order:=1 else order:=0;
  WritevGroup(outidx); {do writevgroup for second group}

end;

```

```

Procedure DoFrameCheck;
var i:integer;
Begin

```

```

  i:=0;
  repeat
    gotoxy(1,1);
    writeln('Waiting for proper sync pulses, type "q" to quit');
    framesum:=0;
    if (frameinterval > 60) and (frameinterval < 120) then
      framesum:= (frameinterval+FrameInterval+frameInterval) div 3;
      {get average time of 3 frames}

```

```

  If (framesum > 60) and (framesum < 120) then {frame interval

```

should be

about 80 ms}

```
begin i:=1; gotoxy(1,1); clreol; end;
until (i=1) or ((keypressed) and ((readkey='q') or (readkey='Q')));
```

```
Write('Frame Interval = ', framesum, ' ms'); {display frame interval on screen}
chanpd:= framesum div 4; {each channel is 1/4 the frame interval}
WriteLn(' Channel Period = ',chanpd, ' ms'); {display channel period on screen}
```

End;

Procedure DoGetData;

var ch: char;

m:word;

fname:string;

Begin

quittest:=' ';

repeat

begin

gotoxy(1,20);

write('Write Data to File (Y or N) ? ');

readln(filewr);

if (filewr='y') or (filewr='Y') then

begin

write('Output file name: ');

read(fname); {get file name from user}

for m:=1 to length(fname) do

fname[m]:=upcase(fname[m]); {convert file

name to caps}

assign(outfile,fname);

end;

end;

until (filewr='y') or (filewr='n') or (filewr='Y') or (filewr='N');

doframecheck;

dcint:=trunc((chanpd-10)/2);

setgatetime(trunc(dcint\*clockfreq));

gotoxy(1,25);

Write('Type "q" to quit');

gotoxy(1,3);

writeln(' Channel Frequencies (Hertz)');

write(' Opt Temp Gnd Opt Temp Vsupp

Set Gate

Width');

gotoxy(66,5);

write(dcint:2, ' ms');

gotoxy(61,7);

write('Actual Gate Width');

gettime(hour,minute,second,sec100);

gotoxy(1,7);

writeln(' Start Time');

write(hour:2,':',minute:2,':',second:2,':',sec100:2);

gotoxy(1,9);

writeln(' Data Converted to % of Vsupp');

```

        write(' Current Time      Opt    Temp');
        if (filewr='y') or (filewr='Y') then rewrite(outfile);

    if (framesum < 120) and (framesum > 60) then
    repeat
        ReadFreqs;
        WriteResults;
        if keypressed then quittest:=readkey;
        until (quittest='q') or (quittest='Q');
        if (filewr='y') or (filewr='Y') then close(outfile);
    End;
    Procedure DoSetGate;
    Begin
        Write('Data Collection interval in milliseconds: ');
        Readln(dcint);
        Setgatetime(trunc((dcint)*clockfreq)); {for 2 MHz clock}
    End;

    begin

        clrscr;
        clockfreq:=2000; {freq in Khz}
        delay(1);

        {Program counters 0 and 1}
        port[ctlreg]:=$34; {set counter 0 to mode 2}
        delay(1);
        port[iobase]:=$FF; {load LSB}
        delay(1);
        port[iobase]:=$FF; {load MSB, initial count is 65535}
        delay(1);
        framesync; {make sure clock 1 has pulses when programming counter 1}
        port[ctlreg]:=$74; {set counter 1 to mode 2}
        delay(3);
        port[iobase+1]:=$FF; {load LSB}
        delay(3);
        port[iobase+1]:=$FF; {load MSB, initial count is 65535}
        delay(3);

        dogetdata;

    End.

```